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Adjourned Meeting, June 27.

Present, twenty-four members.

Mr. Du Ponceau, President, in the Chair.

The communication of Mr. Du Ponceau relative to the origin and formation of the Society, which was presented at the last meeting, was read, and referred to a committee.

A letter was read from Mr. Fisher to Mr. Kane, one of the Secretaries, in relation to the subject of Mr. Du Ponceau's communication, and explanatory of a communication on the same subject from Mr. Fisher, which was afterwards read. The letter and communication were referred to the committee who had charge of the communication of Mr. Du Ponceau.

On motion, it was resolved, that the Maryland Academy of Science and Literature, and the Sociedad Economica de Amigos del Pais de Valencia, should hereafter be furnished regularly with a copy of the published proceedings of this Society.

Mr. Vaughan announced the death of Mr. Wm. H. Keating, a member of the Society, which took place in London, on the 17th May; and, on motion of Mr. Kane, it was resolved, that a member of the Society be requested to prepare an Obituary Notice of the deceased. Dr. Hays was appointed to that office.

In consequence of unfinished business still remaining, it was resolved, that the Society should adjourn to meet again on Friday evening next, and that due notice thereof be given in the public papers by the Librarian.

Adjourned Meeting, July 3.

Present, twenty members.

Mr. Du Ponceau, President, in the Chair.

Professor Bache read a letter from Mr. Rumker, of Hamburg, acknowledging the honour of his election as a member of the Society, and containing astronomical observations in reference to Galle's comets.

The communication was referred to the Committee on Astronomical Observations.

Mr. Breck, after some prefatory remarks, presented for the Library, and read, a Manuscript Essay, written by him for the Society, and entitled "Historical Sketch of the Continental Bills of Credit, from the year 1775 to 1781, with Specimens thereof;" which was referred to the Historical Committee.

Mr. Du Ponceau announced that the Society would receive at their next meeting, the Anamitic and Latin, and Latin and Anamitic Dictionaries, lately published by the Right Reverend Father Taberd, Bishop of Isauropolis, and Vicar General of Cochin China, which he had mentioned to the Society at a former meeting, as in course of publication.

This valuable work was printed at Serampore, under the auspices, and, it is understood, at the expense, of the British Government in India, and of the East India Company, to whom the learned world are already indebted for the publication of the important labours of the late Dr. Morrison, and other works, which have thrown considerable light on the Chinese language, and who are now, with the same liberality, extending the knowledge of the Indo-Chinese idioms, which, until lately, were entirely unknown in America and Europe. It will not be forgotten, Mr. Du Ponceau added, that this Society was the first to make known the Anamitic language, by the publication of Father Morrone's French and Cochin Chinese Vocabulary, and of the Latin and Cochin Chinese Dictionary, in use among the Missionaries in Cochin China, which works, though not so full and so complete as those published by Bishop Taberd, were the first to shed light on that branch of philological science.

Mr. Du Ponceau further observed, that these publications have settled a point, which has been warmly contested by travellers, and others who have contended (and the view has even gained belief among sinologists) that not only the Anamites, whose languages are monosyllabic, and formed on the model of that of China, but the Japanese and Loo Chooans, whose idioms are polysyllabic and formed on quite different principles, could converse with the Chinese and with each other, without knowing one word of each other's spoken language, by means of the Chinese characters, which presented (it was affirmed) to their minds, ideas unconnected with words. Bishop Taberd asserts, on the contrary, that the Cochin Chinese and Chinese cannot understand each other, either orally or in writing; and that the Chinese is, in Cochin China, a learned language, which is studied by the better class, who, by that means, can communicate with the Chinese, but not by means of the vulgar language, spoken or written.*

The following extract contains a statement of these facts in Bishop Taberd's own words.

" Præcipuum nùnc nobis incumbit pauca de characteribus nec non de linguâ Anamiticâ delibare. Dubium non est quin Anamitarum lingua à Sinensi ortum ducat. Ipsorum enim characteres non tantum magnam habent affinitatem cum Sinensibus, sed vel integrè vel particulatìm ab ipsis mutuantur. Attamen utriusque gentis characteres seu hieroglyphi talem subiere commutationem, ut neque legendo, neque loquendo se invicem intelligant. Qui ex honestâ oriuntur familiâ Sinensibus characteribus dant operam, illi enim characteres in usu sunt apud Anamitas tùm in legibus tum in supplicibus libellis et aliis. Qui magna spectant, vel honoribus dignitatibusque inhiant, toto pectore animique impetu in characterum Sinensium studium incumbere debent, et hos scribendo characteres cum Sinensibus colloqui possunt, adeò diversus est pronunciationis modus inter utramque gentem, ut aliter sermonem mutuum habere nequeant. Undè duæ linguæ usurpantur in Cocincinâ; scilicet, lingua Doctorum, seu lingua Sinensis, et lingua communis quæ in usu quotidiano ab omnibus adhibetur et de quâ nùnc sermonem habemus." Monit. p. 1.

Dr. Hare presented copies of a French translation of a Communication, which he had made to the Society, on the subject of Tornadoes, and in reference to a Memoir, by M. Peltier, on the Cause of these Meteors. (See Proceedings of the Society for October 4, 1839, No. 8. p. 122.) The Communication had been translated by him into French, and sent to each member of the National Institute, with the object of showing that the view of M. Peltier, as contained in the *Journal des Débats* of the 17th of July last, was essentially the same as the one which he (Dr. Hare) had offered relative to these meteors; and also that the allegation made before the Academy, by M. Peltier, that Dr. Hare's hypothesis was defective in not taking into account other co-operating forces, as well as those of electricity, was incorrect.

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* This, as the Transactions and Proceedings of the Society testify, has always been the opinion of Mr. Du Ponceau; but it has been much combated both in Asia and Europe.

Dr. Hare made some observations on the effect of the rarefaction of air, on its desiccation and refrigeration, and on other phenomena connected with the presence of aqueous vapour in the atmosphere. He also detailed some experiments, showing that the phenomena of air, heated by re-entering a receiver partially exhausted, were more consistent, in some respects, with the idea that a vacuum has a capacity for heat, than that it is destitute of any appropriate portion of caloric.

Dr. Hare adverted to the fact, that in an essay, published in Silliman's Journal in 1822, he had, agreeably to the authority of Dalton and Davy, stated, that the cold consequent on the rarefaction of air in its ascent towards the upper strata of the atmosphere, was one of the causes of the formation of clouds; and in his text books he had soon after published an engraving of an apparatus, by means of which he was accustomed to illustrate, before his pupils, the transient cloud which arises from a diminution of pressure in air containing aqueous vapour.

In the essay above mentioned, Dr. Hare had alleged, that as much caloric was given out by aqueous vapour, during its conversion into snow, as would be yielded by twice the weight of red-hot powdered glass. But Mr. Espy, he considered, had the merit of being the first to suggest, that the heat, thus evolved, might be an important instrument in causing a buoyancy tending to accelerate any upward current of warm moist air.

Dr. Hare had been willing to admit, that this transfer of heat might co-operate with other causes in the production of storms, but could not concur with Mr. Espy in considering it competent to give rise to thunder gusts, tornadoes, or hurricanes. These he had considered, and still considers, to be mainly owing to electrical discharges between the earth and the sky; or between one mass of clouds and another.

With a view to a more accurate estimate of the comparative influence of rarefaction and condensation, in causing evolution of heat in dry air, and in air replete with aqueous vapour, Dr. Hare had performed a number of experiments, of which he proceeded to give a description.

Large globes, each containing about a cubic foot of space, furnished with thermometers and hygrometers, were made to communicate, respectively, with reservoirs of perfectly dry air, and of air replete with aqueous vapour.* The cold, ultimately acquired by any degree of rarefaction, appeared to be the same, whether the air was in the one state or the other; provided that the air, replete with aqueous vapour, was not in contact with liquid water in the vessel subjected to exhaustion. When water was present, in consequence of the formation of additional vapour, and a consequent absorption of caloric, the cold produced was nearly twice as great as when the air was not in contact with liquid water; being nearly as 9 to 5.

Under the circumstances last mentioned, the hygrometer was motionless; whereas, when no liquid water was accessible, the space, although previously saturated with vapour, by the removal of a portion of it together with the air which is withdrawn by the exhaustion, acquires a capacity for more vapour; and hence the hygrometer, by an abstraction of one-third of the air, revolved more than sixty degrees towards dryness. But when a smaller receiver (after being subjected to a diminution of pressure of about ten inches of mercury, so as to cause the index of the hygrometer to move about thirty-five degrees towards dryness) was surrounded by a freezing mixture, until a thermometer in the axis of the receiver stood at three degrees below freezing, the hygrometer revolved towards dampness, until it went about ten degrees beyond the point at which it rested when the process commenced.

It appears, therefore, that the dryness produced by the degree of rarefaction employed is more than counterbalanced by a freezing temperature.

As respects the heat imparted to the air above mentioned, the fact, that the ultimate refrigeration in the case of air replete with vapour, and in that of anhydrous air, was equally great, and that when water was present the cold was greater in the damp vessel, led to the idea, that the heat arising under such circumstances could not have much efficacy in augmenting the buoyancy of an ascending column of air: but when, by an appropriate mechanism, the refrigeration was measured by the difference of pressure at the moment when the exhaustion was arrested, and when the thermometer had become stationary, it was found cæteris paribus, that the reduction of pressure arising from cold was at least one-half greater in the anhydrous air, than in the air replete with vapour. This difference seems to be owing to a loan of latent heat made by the contained moisture, or transferred from the apparatus by its intervention, which checks the refrigeration; yet, ultimately, the whole of the moisture being converted into vapour, the aggregate refrigeration does not differ in the two cases.

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* The hygrometers were constructed by means of the beard of the avena sensitiva or wild oat, also called animated oat.

Agreeably to Dalton's tables, at 70° the quantity of moisture in 31 grains or 100 cubic inches of air, is $\frac{551}{1000}$ of a grain. The space allotted to this weight of vapour being doubled, it would remain uncondensed at 45° F., being associated with the same weight, but double the volume, of air; but at 32°, notwithstanding the doubling of the space, only $\frac{356}{1000}$ of a grain would remain in the aëriform state; of course $551 - 356 = \frac{195}{1000}$, or nearly $\frac{2}{10}$ of a grain, would be precipitated.

The latent heat given out by the condensation of this vapour, would heat, as is well known, 1000 times its weight of water, or 195 grains, one degree; or 31 grains $\frac{195}{31} = 6.29$ degrees; and as the capacity of air for heat is only one-fourth of that of water, it would heat 31 grains of air $6.29 \times 4 = 25.16$, or nearly 25° F. As air, at 32° F., expands $\frac{1}{480}$ for each additional degree, the difference of bulk, arising from the heat received, as above calculated, would be $\frac{25}{480}$, or $\frac{1}{19}$ nearly.

When air, replete with aqueous vapour, was admitted into a receiver partially exhausted, and containing liquid water, a copious precipitation of moisture ensued, and a rise of temperature greater than when perfectly dry air was allowed to enter a vessel containing rarefied air in the same state. In the instance first mentioned, a portion of vapour rises into the place of that which is withdrawn during the partial exhaustion. Hence when the air, containing its full proportion of vapour, enters, there is an excess of vapour which must precipitate, causing a cloud, and an evolution of latent heat from the aqueous particles previously in the aëriform state. Dr. Hare conceives that as the enlargement of the space occupied by a sponge, allows, proportionably, a larger quantity of any liquid to enter its cells, so any rarefaction of the air when in contact with water, consequent on increase of heat or diminution of pressure, permits a proportionably larger volume of vapour to associate itself with a given weight of the air. When, subsequently, by the afflux of wind replete with aqueous vapour, the density of the aggregate is increased, a portion of the vapour equivalent to the condensation must be condensed, giving out latent heat, excepting so far as the heat thus evolved, being retained by the air, raises the dew point.

Hence, whenever a diminution of density of the air inland causes an influx of sea air to restore the equilibrium, there may result a condensation of aqueous vapour, and evolution of heat, tending to promote an ascending current. This process being followed by that which Mr. Espy has pointed out, of the transfer of heat from vapour to air, during its ascent to the region of the clouds, and consequent precipitation of moisture, might, Dr. H. thought, be among the efficient causes of those *non*-electrical rain storms, during which the water of the Gulf of Mexico, or of the Atlantic, is transferred to the soil of the United States.

Dr. Hare proceeded to mention some additional experiments which he had made, respecting the increase of temperature resulting from the admission of dry air into an exhausted receiver. When the receiver was exhausted so as to reduce the interior pressure to one-fourth of that of the atmosphere, and one-fourth was suddenly admitted, so as to reduce a gage from about 22½ inches to 15 inches, heat was produced; and however the ratio of the entering air to the residual portion was varied, still there was a similar result.

When the cavity of the receiver was supplied with the vapour of ether or with that of water, so as to form, according to the Daltonian hypothesis, a vacuum for the admitted air, still heat was produced by the latter, however small might be the quantity, or rapid the readmission. When the receiver was exhausted, until the tension was less than that of aqueous vapour at the existing temperature, so as to cause the water to boil, as in the Cryophorus, or Leslie's experiment, still the entrance of $\frac{6}{1000}$ of the quantity requisite to fill the receiver caused the thermometer to rise a tenth of a degree. An alternate motion of the key of the cock, through one-fourth of a circle, within one-third of a second of time, was adequate to produce the change last mentioned.

Dr. Hare considered the fact, that heat is produced, when to air, rarefied to one-fourth of the atmospheric density, another fourth is added, irreconcileable with the idea, that this result arises from the compression of the portion of air previously occupying the cavity, since the entering air must be as much expanded as the residual portion is condensed.

As, agreeably to Dalton, a cavity occupied by a vapour acts as a vacuum to any air which may be introduced, Dr. Hare argued, that when a receiver, after being supplied with ether or water, is exhausted so as to remove all the air and leave nothing besides aqueous or etherial vapour, the heat, acquired by air admitted, cannot be ascribed, consistently, to the condensation of the vapour.

The facts above stated, he added, are not reconcileable with the idea of De la Rive and Marcet, that the first portion of the entering air is productive of cold, although a subsequent condensation is productive of an opposite change. The effect upon the thermometer was too rapid, and the quantity of the entering air too minute, to allow it to be refrigerated by rarefaction in the first place, and yet afterwards to be so much condensed as to become warm by the evolution of caloric.

Notwithstanding the experiments of Gay Lussac and of those of De la Rive and Marcet, there appeared to Dr. Hare to be evidence in favour of the heat being due to the space, rather than to the air which it contained.

With respect to Gay Lussac's celebrated experiment with the Torricellian vacuum, supposing such a vacuum to be a pre-eminently good liberator of heat, as it ought in reason to be, the caloric would be absorbed by the mercury as rapidly as this metal could be made to encroach upon the space occupied by the calorific particles.

Admitting that, for equal weights, the specific heat of air is seven times as great as that of mercury, there could not have been a capacity greater than that of about 200 grains of the metal, whereas a very small stratum of this metal, equal to one-fourth of an inch, would, in the apparatus employed, amount to more than a pound.

The rapidity with which a mercurial thermometer is affected by the changes of temperature, in experiments like those which he had been describing, showed, in Dr. Hare's opinion, that there was something not yet understood respecting the transfer of heat in such cases. It was hardly reconcileable with the process of conduction or circulation, as ordinarily understood.

In the experiments of De la Rive and Marcet, in which the entering air being made to impinge upon the bulb of a thermometer, was productive of a fall in the thermometric column, it might be inferred, he conceived, that the bulb interfered with the access of caloric from the space. It was in fact the bulb upon which the air acted previously to its distribution in the space where it could have encountered the due proportion of caloric.

Professor Bache, from the Committee on magnetic observations, read an extract from a letter of Major Sabine, V. P. of the Royal Society of London, stating that the Council of the Society had, on the recommendation of the Committee of Physics, expressed their opinion of the importance to the plan of combined magnetic observations now in progress, that observatories should be established in the United States, and had instructed their President to bring this expression of opinion to the knowledge of the government of this country.

Professor Bache stated that the resolution just referred to had been adopted with a view to aid the efforts of this Society in procuring the erection of observatories, as recommended in their Memorial to the Secretary of War, which had been referred, by that officer, to Congress.

He also read an extract from a subsequent letter from Major Sabine, in reference to the progress of the combined magnetic observations, stating that the Emperor of Russia had ordered the erection of nine magnetic and meteorological observatories in his dominions, to conform, in respect to instruments and times of observations, to the system recommended by the Royal Society. One of these observatories is to be upon the N. W. coast of America.

Professor Bache stated that the regular system of bi-hourly magnetic and meteorological observations was now established in the observatory at the Girard College, and had been in progress since the close of the month of May. He intended, at a future day, to present to the Society the names of the gentlemen, chiefly members of the American Philosophical Society, by whose contributions a fund had been raised to defray the expense of employing the assistants required for these observations.

On the occasion of the May magnetic term day for observations at short intervals, a brilliant aurora had occurred, during which the magnetic instruments were very much disturbed. The details were reserved for future presentation, but it was perhaps proper now to state, that an auroral arch had been visible here a little after ten o'clock. The same phenomenon was observed at Southwick, Mass., by Mr. Holcomb, at a much earlier hour.

Professor Bache read an extract of a letter addressed by Mr. Forshey, of Natchez, to Mr. Espy, in reference to the tornado which occurred there recently.

The writer stated that he had spent much time in examining the track of the storm in the vicinity of Natchez. He had ascertained its extent to have been not less than five or six miles below the city, and twenty miles beyond; its effects having been felt, but with less violence, for nearly one hundred and fifty miles. The track near Natchez was directed sixty degrees to the east of north. After describing the destruction of the city of Natchez, the writer states, that objects were every where blown towards the track of the storm; those directed most westwardly lying invariably below those directed more eastwardly. Mr. Forshey also describes the effect upon the houses as of an explosion outwards. In his view, these facts strongly confirm Mr. Espy's theory of this meteor.

Professor Bache referred to the conformity between the phenomena described by Mr. Forshey, and those which were ascertained by Mr. Espy and himself to have occurred at New Brunswick, N. J., in the tornado of June, 1825.

Stated Meeting, July 17.

Present, thirty-five members.

Mr. Du Ponceau, President, in the Chair.

The following donations were received:—

FOR THE LIBRARY.

Astronomical Observations made at the Royal Observatory, Greenwich, in the Year 1838, under the Direction of George Biddell Airy, Esq., M. A. Astronomer Royal, &c. &c. 4to. London, 1840.—*From the Royal Society.*